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SEQUENCE LISTING

<110> DSM IP ASSETS B.V.

<120> BIOSYNTHETIC PATHWAY GENES

<130> N.84450A SMW

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<150> EP 02255203.8

<151> 2002-07-25

<160> 17

<170> PatentIn version 3.1

<210> 1

<211> 2586

<212> DNA

<213> Propionibacterium freudenreichii

<220>

<221> CDS

<222> (1)..(2586)

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1	5								10				15				

tcc	agc	cag	gga	aag	acc	acc	gtg	gcc	atc	ggc	ctg	atg	gcg	gcc	ctg		96
Ser	Ser	Gln	Gly	Lys	Thr	Thr	Val	Ala	Ile	Gly	Leu	Met	Ala	Ala	Leu		
20									25				30				

cg	g	c	t	g	g	g	c	g	g	t	g	g	g	cc	g	ac	144
Arg	Ala	Ser	Gly	Arg	Ser	Val	Ala	Gly	Phe	Lys	Val	Gly	Pro	Asp	Tyr		
35									40				45				

at	g	a	t	cc	gg	t	at	ca	ct	g	tc	gg	cg	cc	gg	cc	aa	192
Ile	Asp	Pro	Gly	Tyr	His	Ala	Leu	Ala	Cys	Gly	Arg	Pro	Gly	Arg	Asn			
50									55				60					

ct	g	a	t	cc	tt	tg	tc	gg	cc	gg	cc	tt	tc	gg		240
Leu	Asp	Pro	Tyr	Leu	Cys	Gly	Pro	Glu	Arg	Ile	Ala	Pro	Leu	Phe	Ala	
65									70				75			80

ca	gg	cc	tt	ca	cc	gg	cc	gg	at	tc	tc	gg	cc	gg		288
His	Gly	Ala	Leu	His	Pro	Glu	Pro	Ala	Asp	Ile	Ser	Val	Val	Glu	Gly	
85									90				95			

gt	at	gg	at	tt	gc	gg	a	gg	ct	gg	cc	gg	cc	gg	cc	aa	336
Val	Met	Gly	Met	Phe	Asp	Gly	Lys	Leu	Gly	Ala	Trp	Pro	Asp	Gly	Thr		
100									105				110				

ga	tc	cc	gg	tt	gg	cc	tc	cc	ca	tc	gg	cc	gg	cc	aa	384
Asp	Asp	Pro	Ala	Gly	Ser	Ser	Ala	His	Ile	Ala	Arg	Leu	Leu			

115	120	125	
gat gcc ccc gtg ctg ctc gtg gtc gac ggc tca cac agt gcc cgt acc Asp Ala Pro Val Leu Leu Val Val Asp Gly Ser His Ser Ala Arg Thr 130	135	140	432
gcc gca gcc ctg tgc cat ggc ctg gcc agc tac gat ccc cgc atc cat Ala Ala Ala Leu Cys His Gly Leu Ala Ser Tyr Asp Pro Arg Ile His 145	150	155	480
gtg gcc ggc gtc atc ctc aat cgg gtg atg ggt gcc cgc gtg gtc gac Val Ala Gly Val Ile Leu Asn Arg Val Met Gly Ala Arg Val Val Asp 165	170	175	528
gag atc acc cgg ggc tgc gca cgt gtc ggc ctg ccg gtg ctg ggg gct Glu Ile Thr Arg Gly Cys Ala Arg Val Gly Leu Pro Val Leu Gly Ala 180	185	190	576
ctg ccg aaa agc acg cgg gtg gcc gtg ggc tca cgc cac ctg gga ctg Leu Pro Lys Ser Thr Arg Val Ala Val Gly Ser Arg His Leu Gly Leu 195	200	205	624
gtc acg gcc gac gag cag ggt gac ggc atc ggc atc gtg cag cag gcc Val Thr Ala Asp Glu Gln Gly Asp Ala Ile Gly Ile Val Gln Gln Ala 210	215	220	672
ggt gag ctc gtc gcc gca cac ctc gac ctc gac gcc atc gcc acg atc Gly Glu Leu Val Ala Ala His Leu Asp Leu Asp Ala Ile Ala Thr Ile 225	230	235	720
gcc ggt ggg gcc cct gac ctg gcc gtc gat ccc tgg gat ccc gcc gca Ala Gly Ala Pro Asp Leu Ala Val Asp Pro Trp Asp Pro Ala Ala 245	250	255	768
gag gtc gaa ccg gta ccg ggg cgt ccg gtc atc gcc atg gcc tcg ggt Glu Val Glu Pro Val Pro Gly Arg Pro Val Ile Ala Met Ala Ser Gly 260	265	270	816
ccc gca ttc acc ttc cgg tac acc gaa acc gca gaa ctg ctg gag gcg Pro Ala Phe Thr Phe Arg Tyr Thr Glu Thr Ala Glu Leu Leu Glu Ala 275	280	285	864
gcc ggc tgc cgg gtg acg gcc ttc gat ccg ctc acc gcc cgg ggc ctt Ala Gly Cys Arg Val Thr Ala Phe Asp Pro Leu Thr Ala Arg Gly Leu 290	295	300	912
ccg gcc gat gtg tcc ggc ctg tac ctg ggg ggt ggt ttc ccc gag gag Pro Ala Asp Val Ser Gly Leu Tyr Leu Gly Gly Phe Pro Glu Glu 305	310	315	960
cac gcc gag gcg ctc gcc ggc aac acc tcc ctg ggc gct gaa atc gcc His Ala Glu Ala Leu Ala Gly Asn Thr Ser Leu Gly Ala Glu Ile Ala 325	330	335	1008
tca cgc gtg tcc gag ggc ctg ccg acg gtg gcc gag tgt gcg ggg ctg Ser Arg Val Ser Glu Gly Leu Pro Thr Val Ala Glu Cys Ala Gly Leu 340	345	350	1056
ctc tac ctg tgc cgc agc ctg gat gga ctg gcg atg gcc ggg gtg gtc			1104

Leu Tyr Leu Cys Arg Ser Leu Asp Gly Leu Ala Met Ala Gly Val Val			
355	360	365	
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Asp Ala Asp Ser Ser Met Thr Pro Arg Leu Thr Ile Gly Tyr His His			
370	375	380	
gcc cgc gcc gac aac gac agc ttc ctg atg cgc gcc ggg gag cgc tat			1200
Ala Arg Ala Ala Asn Asp Ser Phe Leu Met Arg Ala Gly Glu Arg Tyr			
385	390	395	400
cgg gcc cat gag ttc cac cgc acc acc ctg gac acg ccc ccc tac gac			1248
Arg Ala His Glu Phe His Arg Thr Thr Leu Asp Thr Pro Pro Tyr Asp			
405	410	415	
cgc gac ccc gga cca caa cgg ctg ggc gac caa cgg ttg gcg tgg gac			1296
Arg Asp Pro Gly Pro Gln Arg Leu Gly Asp Gln Arg Leu Ala Trp Asp			
420	425	430	
gtg gag acc ccg acg ggg ggc aac cga ccc gag ggg gtg ctg gtc gcc			1344
Val Glu Thr Pro Thr Gly Gly Asn Arg Pro Glu Gly Val Leu Val Ala			
435	440	445	
ccg acc ccc ggt tcc gcg ccc agc gtc cac gcc tcc tac cag cac ctg			1392
Pro Thr Pro Gly Ser Ala Pro Ser Val His Ala Ser Tyr Gln His Leu			
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cac tgg gca ggg agt ccg gta ctg gcg caa cgc ttc gcc cgg gcg gcg			1440
His Trp Ala Gly Ser Pro Val Leu Ala Gln Arg Phe Ala Arg Ala Ala			
465	470	475	480
agc gaa tat ggg cac acc ggc cat cac tcc ccc cgg cct gcc gcc acg			1488
Ser Glu Tyr Gly His Thr Gly His His Ser Pro Arg Pro Ala Ala Thr			
485	490	495	
acg ccg gga gat gcg ttg tcc gca gcg ccc gac ctc acc cat cac ggg			1536
Thr Pro Gly Asp Ala Leu Ser Ala Ala Pro Asp Leu Thr His His Gly			
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gat cgc gat gtg ctg ccc ggc ctg gtc gac ttg gcg gtg aac gtg cgc			1584
Asp Arg Asp Val Leu Pro Gly Leu Val Asp Leu Ala Val Asn Val Arg			
515	520	525	
gat gtg cga cct ccg gcc tgg ctc gtg gag cgc atc gtc gcc tcc agc			1632
Asp Val Arg Pro Pro Ala Trp Leu Val Glu Arg Ile Val Ala Ser Ser			
530	535	540	
gac cag tgg gcc cac tac ccc gat cag cgc gaa gcg acc cgt gcg gtg			1680
Asp Gln Trp Ala His Tyr Pro Asp Gln Arg Glu Ala Thr Arg Ala Val			
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gca ctg cgc cat ggc gtc aac ccc gac cag gta ctg ctc acc gcc ggg			1728
Ala Leu Arg His Gly Val Asn Pro Asp Gln Val Leu Leu Thr Ala Gly			
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Ser Ser Glu Ala Phe Ser Leu Ile Ala His Gly Phe Ser Pro Arg Trp			
580	585	590	

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gtc acc gcc cgc gaa tgc tcc acg cca cgc gcc gtg gag cag gcc acc Val Thr Ala Arg Glu Cys Ser Thr Pro Arg Ala Val Glu Gln Ala Thr 740 745 750	2256
tca gat gcc cga cag gcg gcg cag gac cgc cga cac ctg gtg gcc cgc Ser Asp Ala Arg Gln Ala Ala Gln Asp Arg Arg His Leu Val Ala Arg 755 760 765	2304
ctg gcc ggg atc ggc atc cag acc gtc ggg gag gcc agg gcc ccc ttc Leu Ala Gly Ile Gly Ile Gln Thr Val Gly Glu Ala Arg Ala Pro Phe 770 775 780	2352
gtc cta gtc gac ctg cgc gcc cac ccc ggt ggg ctt cgt gcg gga Val Leu Val Asp Leu Arg Ala His Pro Pro Gly Gly Leu Arg Ala Gly 785 790 795 800	2400
ttg cgg acg ctc ggc ttc acc gtg cgc agc ggc gag agc ttc ccc ggc Leu Arg Thr Leu Gly Phe Thr Val Arg Ser Gly Glu Ser Phe Pro Gly 805 810 815	2448
ctg ggc gcg ggc tgg ttg cgg ctc gcg gtt cgc cac ccg gac atc agc Leu Gly Ala Gly Trp Leu Arg Leu Ala Val Arg His Pro Asp Ile Ser 820 825 830	2496

gac gcg ttc gtc gct gcc ctg gcc cgc acc atc gac gca ctg gac aca 2544
 Asp Ala Phe Val Ala Ala Leu Ala Arg Thr Ile Asp Ala Leu Asp Thr
 835 840 845

 gcg cag cac ccc atg cga cca cca caa gga gac atc aga tga 2586
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 850 855 860

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 35 40 45

 Ile Asp Pro Gly Tyr His Ala Leu Ala Cys Gly Arg Pro Gly Arg Asn
 50 55 60

 Leu Asp Pro Tyr Leu Cys Gly Pro Glu Arg Ile Ala Pro Leu Phe Ala
 65 70 75 80

 His Gly Ala Leu His Pro Glu Pro Ala Asp Ile Ser Val Val Glu Gly
 85 90 95

 Val Met Gly Met Phe Asp Gly Lys Leu Gly Ala Trp Pro Asp Gly Thr
 100 105 110

 Asp Asp Pro Ala Gly Phe Gly Ser Ser Ala His Ile Ala Arg Leu Leu
 115 120 125

 Asp Ala Pro Val Leu Leu Val Val Asp Gly Ser His Ser Ala Arg Thr
 130 135 140

 Ala Ala Ala Leu Cys His Gly Leu Ala Ser Tyr Asp Pro Arg Ile His
 145 150 155 160

 Val Ala Gly Val Ile Leu Asn Arg Val Met Gly Ala Arg Val Val Asp
 165 170 175

 Glu Ile Thr Arg Gly Cys Ala Arg Val Gly Leu Pro Val Leu Gly Ala
 180 185 190

 Leu Pro Lys Ser Thr Arg Val Ala Val Gly Ser Arg His Leu Gly Leu
 195 200 205

 Val Thr Ala Asp Glu Gln Gly Asp Ala Ile Gly Ile Val Gln Gln Ala
 210 215 220

 Gly Glu Leu Val Ala Ala His Leu Asp Leu Asp Ala Ile Ala Thr Ile

225	230	235	240
Ala Gly Gly Ala Pro Asp Leu Ala Val Asp Pro Trp Asp Pro Ala Ala			
245	250	255	
Glu Val Glu Pro Val Pro Gly Arg Pro Val Ile Ala Met Ala Ser Gly			
260	265	270	
Pro Ala Phe Thr Phe Arg Tyr Thr Glu Thr Ala Glu Leu Leu Glu Ala			
275	280	285	
Ala Gly Cys Arg Val Thr Ala Phe Asp Pro Leu Thr Ala Arg Gly Leu			
290	295	300	
Pro Ala Asp Val Ser Gly Leu Tyr Leu Gly Gly Gly Phe Pro Glu Glu			
305	310	315	320
His Ala Glu Ala Leu Ala Gly Asn Thr Ser Leu Gly Ala Glu Ile Ala			
325	330	335	
Ser Arg Val Ser Glu Gly Leu Pro Thr Val Ala Glu Cys Ala Gly Leu			
340	345	350	
Leu Tyr Leu Cys Arg Ser Leu Asp Gly Leu Ala Met Ala Gly Val Val			
355	360	365	
Asp Ala Asp Ser Ser Met Thr Pro Arg Leu Thr Ile Gly Tyr His His			
370	375	380	
Ala Arg Ala Ala Asn Asp Ser Phe Leu Met Arg Ala Gly Glu Arg Tyr			
385	390	395	400
Arg Ala His Glu Phe His Arg Thr Thr Leu Asp Thr Pro Pro Tyr Asp			
405	410	415	
Arg Asp Pro Gly Pro Gln Arg Leu Gly Asp Gln Arg Leu Ala Trp Asp			
420	425	430	
Val Glu Thr Pro Thr Gly Gly Asn Arg Pro Glu Gly Val Leu Val Ala			
435	440	445	
Pro Thr Pro Gly Ser Ala Pro Ser Val His Ala Ser Tyr Gln His Leu			
450	455	460	
His Trp Ala Gly Ser Pro Val Leu Ala Gln Arg Phe Ala Arg Ala Ala			
465	470	475	480
Ser Glu Tyr Gly His Thr Gly His His Ser Pro Arg Pro Ala Ala Thr			
485	490	495	
Thr Pro Gly Asp Ala Leu Ser Ala Ala Pro Asp Leu Thr His His Gly			
500	505	510	
Asp Arg Asp Val Leu Pro Gly Leu Val Asp Leu Ala Val Asn Val Arg			
515	520	525	
Asp Val Arg Pro Pro Ala Trp Leu Val Glu Arg Ile Val Ala Ser Ser			
530	535	540	

Asp Gln Trp Ala His Tyr Pro Asp Gln Arg Glu Ala Thr Arg Ala Val
 545 550 555 560
 Ala Leu Arg His Gly Val Asn Pro Asp Gln Val Leu Leu Thr Ala Gly
 565 570 575
 Ser Ser Glu Ala Phe Ser Leu Ile Ala His Gly Phe Ser Pro Arg Trp
 580 585 590
 Ala Val Val Val His Pro Gln Phe Thr Glu Pro Glu Val Ala Leu Arg
 595 600 605
 Asn Ala Gly Arg Pro Val Gly Arg Leu Val Leu His Ala Ser Asp Gly
 610 615 620
 Phe Gln Phe Asp His Glu Leu Leu Asp Pro Arg Ala Asp Met Val Val
 625 630 635 640
 Ile Gly Asn Pro Thr Asn Pro Thr Gly Val Leu His Ser Ala Ala Ser
 645 650 655
 Leu Arg Ala Leu Cys Arg Pro Gly Arg Val Val Val Val Asp Glu Ala
 660 665 670
 Phe Met Asp Ala Val Pro Gly Glu Pro Glu Ser Leu Ile Gly Ala Arg
 675 680 685
 Met Asp Gly Leu Leu Val Thr Arg Ser Phe Thr Lys Thr Trp Ser Val
 690 695 700
 Pro Gly Leu Arg Ile Gly Tyr Val Val Gly Asp Pro Ala Leu Ile Arg
 705 710 715 720
 Val Leu Ala His Glu Gln Pro Cys Trp Pro Ile Ser Thr Pro Ala Leu
 725 730 735
 Val Thr Ala Arg Glu Cys Ser Thr Pro Arg Ala Val Glu Gln Ala Thr
 740 745 750
 Ser Asp Ala Arg Gln Ala Ala Gln Asp Arg Arg His Leu Val Ala Arg
 755 760 765
 Leu Ala Gly Ile Gly Ile Gln Thr Val Gly Glu Ala Arg Ala Pro Phe
 770 775 780
 Val Leu Val Asp Leu Arg Ala His Pro Pro Gly Gly Leu Arg Ala Gly
 785 790 795 800
 Leu Arg Thr Leu Gly Phe Thr Val Arg Ser Gly Glu Ser Phe Pro Gly
 805 810 815
 Leu Gly Ala Gly Trp Leu Arg Leu Ala Val Arg His Pro Asp Ile Ser
 820 825 830
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	10
	15

tca ggc ctc ggt gcc cgg caa cgt ccg gca cga acc ctc gtc acc ggg	96
Ser Gly Leu Gly Ala Arg Gln Arg Pro Ala Arg Thr Leu Val Thr Gly	
20	25
	30

ggc gcc cgg agc ggg aag tcc agc tat gcc gag gcg ctg ctg ggg tcg	144
Gly Ala Arg Ser Gly Lys Ser Ser Tyr Ala Glu Ala Leu Leu Gly Ser	
35	40
	45

ttc gac cac gtc gac tac atc gcc acc tcg caa cgc aac cct gac gac	192
Phe Asp His Val Asp Tyr Ile Ala Thr Ser Gln Arg Asn Pro Asp Asp	
50	55
	60

ccc gag tgg atg gcc cgc atc gcc ccc cac gtc gcg cgc cgc ccc aag	240
Pro Glu Trp Met Ala Arg Ile Ala Ala His Val Ala Arg Arg Pro Lys	
65	70
	75
	80

agc tgg aac acc gtg gag acc ctt gac gtg gcg cag gtg ctg tcc gac	288
Ser Trp Asn Thr Val Glu Thr Leu Asp Val Ala Gln Val Leu Ser Asp	
85	90
	95

gac ggc tcc ccc gcc ctg gtc gat tgc ctg ggc gtc tgg ctc acc cgc	336
Asp Gly Ser Pro Ala Leu Val Asp Cys Leu Gly Val Trp Leu Thr Arg	
100	105
	110

gag ctg gac gtc acc gac gcc tgg cag cac ccg gag cag gcc cgc ccc	384
Glu Leu Asp Val Thr Asp Ala Trp Gln His Pro Glu Gln Ala Arg Pro	
115	120
	125

gag ctg cag cac cgc atc gat gag ttg gcc act gcg gtc gcc ggc tcc	432
Glu Leu Gln His Arg Ile Asp Glu Leu Ala Thr Ala Val Ala Gly Ser	
130	135
	140

ccg cgc cgc gtc gtg ctg gtc acc aac gag gtc ggt tcc ggc gtc gtc	480
Pro Arg Arg Val Val Leu Val Thr Asn Glu Val Gly Ser Gly Val Val	
145	150
	155
	160

ccc gcc acg cag gca ggg cgc acc ttc cgt gac tgg ctg gga atc ctc	528
Pro Ala Thr Gln Ala Gly Arg Thr Phe Arg Asp Trp Leu Gly Ile Leu	
165	170
	175

aac gcc agc gtc gcg gac gcc tgc gac gag gta ctg ctg tgc gtc gcc	576
Asn Ala Ser Val Ala Asp Ala Cys Asp Glu Val Leu Cys Val Ala	

180	185	190	
gga cgg gcg ctg agc ctg cca ccg cga ccg gga ggc cct cat ggc gcc Gly Arg Ala Leu Ser Leu Pro Pro Arg Pro Gly Gly Pro His Gly Ala			624
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Ser Gly Leu Gly Ala Arg Gln Arg Pro Ala Arg Thr Leu Val Thr Gly 20	25		30
Gly Ala Arg Ser Gly Lys Ser Ser Tyr Ala Glu Ala Leu Leu Gly Ser 35	40		45
Phe Asp His Val Asp Tyr Ile Ala Thr Ser Gln Arg Asn Pro Asp Asp 50	55	60	
Pro Glu Trp Met Ala Arg Ile Ala Ala His Val Ala Arg Arg Pro Lys 65	70	75	80
Ser Trp Asn Thr Val Glu Thr Leu Asp Val Ala Gln Val Leu Ser Asp 85	90		95
Asp Gly Ser Pro Ala Leu Val Asp Cys Leu Gly Val Trp Leu Thr Arg 100	105		110
Glu Leu Asp Val Thr Asp Ala Trp Gln His Pro Glu Gln Ala Arg Pro 115	120		125
Glu Leu Gln His Arg Ile Asp Glu Leu Ala Thr Ala Val Ala Gly Ser 130	135		140
Pro Arg Arg Val Val Leu Val Thr Asn Glu Val Gly Ser Gly Val Val 145	150	155	160
Pro Ala Thr Gln Ala Gly Arg Thr Phe Arg Asp Trp Leu Gly Ile Leu 165	170		175
Asn Ala Ser Val Ala Asp Ala Cys Asp Glu Val Leu Leu Cys Val Ala 180	185		190
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Gly Thr Asp Pro Gln Pro Lys Asp Ala Ile 210	215		

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ctg ccc gca ccc gtg gtg gcc gag gtg gat gag cga ctc gcc gtg cgg 96
Leu Pro Ala Pro Val Val Ala Glu Val Asp Glu Arg Leu Ala Val Arg
20 25 30

gcg atc gcc tcg atg ccc tgg gtc ggc ctc gga ctg ggc ctg atc gcc 144
Ala Ile Ala Ser Met Pro Trp Val Gly Leu Gly Leu Gly Leu Ile Ala
35 40 45

gga ctc ggc tgc gcc atc gtc acc gtc gcg ggg ggc ggc cag cca ctg 192
Gly Leu Gly Cys Ala Ile Val Thr Val Ala Gly Gly Gly Gln Pro Leu
50 55 60

gca atc gca gca ggc ctg gca atc ctg gcc ctg tgc acc ggc ttc ctg 240
Ala Ile Ala Ala Gly Leu Ala Ile Leu Ala Leu Cys Thr Gly Phe Leu
65 70 75 80

cac ctc gac gga ctc gcc gac acc gcc gac ggc ctg ggc tcc cgc aag 288
His Leu Asp Gly Leu Ala Asp Thr Ala Asp Gly Leu Gly Ser Arg Lys
85 90 95

ccg gcc cac gag gcc ctg acc atc atg cgc caa tca gac atc ggg ccc 336
Pro Ala His Glu Ala Leu Thr Ile Met Arg Gln Ser Asp Ile Gly Pro
100 105 110

atg ggc gtc acc gcc atc atc ctc gtg ctg gcg ttg gag atc gcg gca 384
Met Gly Val Thr Ala Ile Ile Leu Val Leu Ala Leu Glu Ile Ala Ala
115 120 125

ggc ggt tca gga cac ctt gat ggc tgg cgt ggc gtc tgg ctg ctg gtg 432
Gly Gly Ser Gly His Leu Asp Gly Trp Arg Gly Val Trp Leu Leu Val
130 135 140

aca atg ccc atg gtg gcg cgc gtc agc gcc ctg tcc gcc acc gga cga 480
Thr Met Pro Met Val Ala Arg Val Ser Ala Leu Ser Ala Thr Gly Arg
145 150 155 160

tgg att ccg agc gcc cac aag aag ggg ttc gga gcg ctc ttc gcc gga 528
Trp Ile Pro Ser Ala His Lys Lys Gly Phe Gly Ala Leu Phe Ala Gly
165 170 175

aag acg cac cct gcg acg atc gtg gtc gcc tca gtg atc gcc gcg gtg 576
Lys Thr His Pro Ala Thr Ile Val Val Ala Ser Val Ile Ala Ala Val
180 185 190

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 35 40 45
 Gly Leu Gly Cys Ala Ile Val Thr Val Ala Gly Gly Gly Gln Pro Leu
 50 55 60
 Ala Ile Ala Ala Gly Leu Ala Ile Leu Ala Leu Cys Thr Gly Phe Leu
 65 70 75 80
 His Leu Asp Gly Leu Ala Asp Thr Ala Asp Gly Leu Gly Ser Arg Lys
 85 90 95
 Pro Ala His Glu Ala Leu Thr Ile Met Arg Gln Ser Asp Ile Gly Pro
 . 100 105 110
 Met Gly Val Thr Ala Ile Ile Leu Val Leu Ala Leu Glu Ile Ala Ala
 115 120 125
 Gly Gly Ser Gly His Leu Asp Gly Trp Arg Gly Val Trp Leu Leu Val
 130 135 140
 Thr Met Pro Met Val Ala Arg Val Ser Ala Leu Ser Ala Thr Gly Arg
 145 150 155 160
 Trp Ile Pro Ser Ala His Lys Lys Gly Phe Gly Ala Leu Phe Ala Gly

165	170	175	
Lys Thr His Pro Ala Thr Ile Val Val Ala Ser Val Ile Ala Ala Val			
180	185	190	
Ile Ala Ala Gly Ser Gly Trp Leu Leu Phe Gly Trp Arg Ala Ala Leu			
195	200	205	
Val Ala Val Cys Ala Cys Leu Ala Ser Trp Val Phe Gly Val Ala Trp			
210	215	220	
Arg Arg His Ile Leu Ala Arg Leu Gly Gly Leu Thr Gly Asp Thr Phe			
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Gly Ser Leu Val Glu Met Ser Gly Leu Ala Tyr Leu Leu Thr Leu Ala			
245	250	255	
Leu Phe Ala			

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cgc cac cgc ccc cga ctg atc gtg aac acc ggg aac ggc aag ggc aag			96
Arg His Arg Pro Arg Leu Ile Val Asn Thr Gly Asn Gly Lys Gly Lys			
20	25	30	
tcc acc gcc gca ttc ggc atg gga ctg cgg gcc tgg gcg cag ggc tgg			144
Ser Thr Ala Ala Phe Gly Met Gly Leu Arg Ala Trp Ala Gln Gly Trp			
35	40	45	
tcg atc ggg gtc ttc cag ttc atc aag tcg gga cgt tgg cac acc ggc			192
Ser Ile Gly Val Phe Gln Phe Ile Lys Ser Gly Arg Trp His Thr Gly			
50	55	60	
gag cag cag gcc tat gca cag ctc gac cag gcc cat cgg acg acc gga			240
Glu Gln Gln Ala Tyr Ala Gln Leu Asp Gln Ala His Arg Thr Thr Gly			
65	70	75	80
gtc ggc gga ccg gtg gaa tgg caa tca ctc gga tcc ggc tgg tcg tgg			288
Val Gly Gly Pro Val Glu Trp Gln Ser Leu Gly Ser Gly Trp Ser Trp			
85	90	95	
ctg agg gcg acc gag ggc acc gac cag gca gcc atg gcg gcc gcg ggc			336
Leu Arg Ala Thr Glu Gly Thr Asp Gln Ala Ala Met Ala Ala Gly			
100	105	110	

tgg gcc cac gtg cgc acc ctg ctc gcc gca cag acc cac cgg ctc tac Trp Ala His Val Arg Thr Leu Leu Ala Ala Gln Thr His Arg Leu Tyr 115 120 125	384
atc ctc gac gaa ttc gcc cat gtg ctc aac aag gga tgg ctg gat gtc Ile Leu Asp Glu Phe Ala His Val Leu Asn Lys Gly Trp Leu Asp Val 130 135 140	432
gac gag gtc gct gac gac ctg gca cat cgt ccc ggc acg caa cat gtg Asp Glu Val Ala Asp Asp Leu Ala His Arg Pro Gly Thr Gln His Val 145 150 155 160	480
gtg atc acc gga cgc aac tgc ccc gcc gga atc atc ggg atc gcc gac Val Ile Thr Gly Arg Asn Cys Pro Ala Gly Ile Ile Gly Ile Ala Asp 165 170 175	528
atc gtc acg tcc atg gac aac gtc aaa cat ccc ttt ggc aag gga gaa Ile Val Thr Ser Met Asp Asn Val Lys His Pro Phe Gly Lys Gly Glu 180 185 190	576
cga gga cag gcg ggt atc gaa tgg tga Arg Gly Gln Ala Gly Ile Glu Trp 195 200	603

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Met Ser Gly Ser Ala Pro Gln Arg Thr Glu Pro Thr Thr Ala Glu Leu 1 5 10 15	
Arg His Arg Pro Arg Leu Ile Val Asn Thr Gly Asn Gly Lys Gly Lys 20 25 30	
Ser Thr Ala Ala Phe Gly Met Gly Leu Arg Ala Trp Ala Gln Gly Trp 35 40 45	
Ser Ile Gly Val Phe Gln Phe Ile Lys Ser Gly Arg Trp His Thr Gly 50 55 60	
Glu Gln Gln Ala Tyr Ala Gln Leu Asp Gln Ala His Arg Thr Thr Gly 65 70 75 80	
Val Gly Gly Pro Val Glu Trp Gln Ser Leu Gly Ser Gly Trp Ser Trp 85 90 95	
Leu Arg Ala Thr Glu Gly Thr Asp Gln Ala Ala Met Ala Ala Gly 100 105 110	
Trp Ala His Val Arg Thr Leu Leu Ala Ala Gln Thr His Arg Leu Tyr 115 120 125	
Ile Leu Asp Glu Phe Ala His Val Leu Asn Lys Gly Trp Leu Asp Val 130 135 140	
Asp Glu Val Ala Asp Asp Leu Ala His Arg Pro Gly Thr Gln His Val	

145 150 155 160

Val Ile Thr Gly Arg Asn Cys Pro Ala Gly Ile Ile Gly Ile Ala Asp
165 170 175

Ile Val Thr Ser Met Asp Asn Val Lys His Pro Phe Gly Lys Gly Glu
180 185 190

Arg Gly Gln Ala Gly Ile Glu Trp
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